



M201EW01 V3

**Document Version: 1.0****Date: 2006/11/21**

## Product Functional Specification

**20.1 inch WSXGA+ Color TFT LCD Module**  
**Model Name: M201EW01 V3**

( ) Preliminary Specification

(◆) Final Specification

**Note: This Specification is subject to change without notice.**

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Ver 1.0

1/30



M201EW01 V3

## AU OPTRONICS CORPORATION

### Product Specification

#### 20.1" Wide SXGA<sup>+</sup> Color TFT-LCD Module

Model Name: M201EW01 V.3

| Approved by   | Prepared by       |
|---------------|-------------------|
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## Record of Revision

| Version and Date  | Page | Old description                                             | New Description                                              | Remark |
|-------------------|------|-------------------------------------------------------------|--------------------------------------------------------------|--------|
| 0.1<br>2006/01/18 | All  | First Edition for Customer                                  | All                                                          |        |
| 0.2<br>2006/02/06 | 16   | FCFL Typ: 50; Max: 60 [KHz]                                 | FCFL Typ. 55; Max. 80 [KHz]                                  |        |
|                   |      | ViCFL (0°C) Min:1950 [Volt]                                 | ViCFL (0°C) Min: 2120 [Volt]                                 |        |
|                   |      | ViCF (25°C) Min:1495 [Volt]                                 | ViCF (25°C) Min: 1625 [Volt]                                 |        |
|                   |      | VCFL Min 740@8mA<br>Typ 760@7mA<br>Max 860@3mA              | VCFL Min 750@8mA;<br>Typ 783@7mA;<br>Max 936@3mA             |        |
|                   |      | PCFL Typ: 32[Watt]                                          | PCFL Typ: 32.9[Watt]                                         |        |
|                   | 13   | 4.1 TFT LCD Module<br>Logic/LCD Drive Voltage Max: 6 [Volt] | 4.1 TFT LCD Module<br>Logic/LCD Drive Voltage Max: 14 [Volt] |        |
|                   | 14   | 5.1.1 Power specification<br>IDD Typ 500 Max 550 [mA]       | 5.1.1 Power specification<br>IDD Typ 550 Max 650 [mA]        |        |
|                   |      | 5.1.1 Power specification<br>Irush Max:7 [A]                | 5.1.1 Power specification<br>Irush Max: 2.5 [A]              |        |
|                   |      | 5.1.1 Power specification<br>PDD Typ:6; Max:7 [Watt]        | 5.1.1 Power specification<br>PDD Typ:6.6; Max:8 [Watt]       |        |
|                   | 12   | Mating type:<br>HRS: MDF76TW-30S-1H(58)                     | Mating type:<br>F I-X30S-H                                   |        |
|                   | 22   | Mating house part number:<br>HRS: MDF76TW-30S-1H(58)        | Mating house part number:<br>FI-X30S-H                       |        |
| 0.3<br>2006/4/26  | 17   | ViCFL (0°C) Min: 2120 [Volt]                                | ViCFL (0°C) Min: 1800 [Volt]                                 |        |
|                   |      | ViCF (25°C) Min: 1625 [Volt]                                | ViCF (25°C) Min: 1450 [Volt]                                 |        |
|                   |      | VCFL Min 750@8mA;<br>Typ 783@7mA;<br>Max 936@3mA            | VCFL Min 751@8mA;<br>Typ 787@7mA;<br>Max 938@3mA             |        |
|                   |      | PCFL Typ: 32.9[Watt]                                        | PCFL Typ: 33.1[Watt]                                         |        |
|                   | 9    | Color / Chromaticity Coordinates (CIE)                      | Red x : Min 0.618; Typ 0.648; Max 0.678                      |        |
|                   |      | Color / Chromaticity Coordinates (CIE)                      | Red y : Min 0.310; Typ 0.340; Max 0.370                      |        |
|                   |      | Color / Chromaticity Coordinates (CIE)                      | Green x : Min 0.257; Typ 0.287; Max 0.317                    |        |
|                   |      | Color / Chromaticity Coordinates (CIE)                      | Green y 572: Min 0.602; Typ 0.; Max 0.632                    |        |
|                   |      | Color / Chromaticity Coordinates (CIE)                      | Blue x : Min 0.115; Typ 0.145; Max 0.175                     |        |



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|                   |    |                                                                                                                                                                                |                                                                                                                                                                                |     |
|-------------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|                   |    | Color / Chromaticity Coordinates (CIE)                                                                                                                                         | Blue y : Min 0.036; Typ 0.066; Max 0.096                                                                                                                                       |     |
|                   | 8  | NA                                                                                                                                                                             | ROHS compliance                                                                                                                                                                |     |
| 0.4<br>2006/8/30  | 8  | Power Consumption<br>(VDD line + CCFL line)<br>30W(Typ) (w/o Inverter, All white pattern)                                                                                      | Power Consumption<br>(VDD line + CCFL line)<br>39.7W(Typ) (w/o Inverter, All white pattern)                                                                                    |     |
|                   | 17 | Note 6: Definition of life: brightness becomes 50% or less than the minimum luminance value of CCFL..The typical life time of CCFL is on the condition at 6.0 mA lamp current. | Note 6: Definition of life: brightness becomes 50% or less than the minimum luminance value of CCFL..The typical life time of CCFL is on the condition at 7.0 mA lamp current. |     |
| 0.5<br>2006/11/01 | 20 | Clock period 12.3<br>Clock Frequency 81                                                                                                                                        | Clock period 13.3<br>Clock Frequency 75                                                                                                                                        |     |
| 1.0<br>2006/11/21 | 8  | White Luminance 300 cd/m <sup>2</sup> @7mA (Typ)                                                                                                                               | White Luminance 300 cd/m <sup>2</sup> @7mA Full White (Typ)                                                                                                                    |     |
|                   | 8  | Weight 2950                                                                                                                                                                    | Weight 2900                                                                                                                                                                    |     |
|                   | 9  | White Luminance at CCFL 7.0mA<br>(central point)                                                                                                                               | White Luminance at CCFL 7.0mA Full White (central point)                                                                                                                       |     |
|                   | 14 | --                                                                                                                                                                             | Note 3: Maximum Wet-Bulb should be 39 °C and No condensation.                                                                                                                  | Add |



## 1.0 Handling Precautions

- 1) Since front polarizer is easily damaged, pay attention not to scratch it.
- 2) Be sure to turn off power supply when inserting or disconnecting from input connector.
- 3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- 4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- 5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
- 6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
- 7) Do not open nor modify the Module Assembly.
- 8) Do not press or pat the panel surface by fingers, hand or tooling
- 9) Do not press the reflector sheet at the back of the module to any directions.
- 10) In case if a module has to be put back into the packing container slot after once it was taken out from the container, do not press the center of the CCFL reflector edge. Instead, press at the far ends of the CCFL reflector edge softly. Otherwise the TFT module may be damaged.
- 11) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT module.
- 12) After installation of the TFT module into an enclosure (Desktop monitor Bezel, for example), do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT module from outside. Otherwise the TFT module may be damaged.



## 2.0 General Description

This specification applies to the 20.1 inch-wide Color TFT-LCD Module M201EW01.

The display supports the WSXGA+ (1680(H) x 1050(V)) screen format and 16.7M colors (RGB 8-bits data).

All input signals are 2 Channel LVDS interface compatible.

This module does not contain an inverter card for backlight.

## 2.1 Display Characteristics

The following items are characteristics summary on the table under 25 °C condition:

| ITEMS                                       | Unit                 | SPECIFICATIONS                                   |
|---------------------------------------------|----------------------|--------------------------------------------------|
| Screen Diagonal                             | [mm]                 | 511.13 (20.1" Wide)                              |
| Active Area                                 | [mm]                 | 433.44 (H) x 270.90 (V)                          |
| Pixels H x V                                |                      | 1680(x3) x 1050                                  |
| Pixel Pitch                                 | [mm]                 | 0.258 (per one triad) x 0.258                    |
| Pixel Arrangement                           |                      | R.G.B. Vertical Stripe                           |
| Display Mode                                |                      | Normally Black by AUO AMVA                       |
| White Luminance ( Center )                  | [cd/m <sup>2</sup> ] | 300 cd/m <sup>2</sup> @7mA Full white(Typ)       |
| Contrast Ratio                              |                      | 1000 : 1 (Typ)                                   |
| Optical Response Time                       | [msec]               | 16ms (Typ, on/off) ; 8ms (Average, grey to grey) |
| Color Saturation                            |                      | 72% NTSC                                         |
| Nominal Input Voltage VDD                   | [Volt]               | +12 V                                            |
| Power Consumption<br>(VDD line + CCFL line) | [Watt]               | 39.7W(Typ) (w/o Inverter, All white pattern)     |
| Weight                                      | [Grams]              | 2900 (Typ)                                       |
| Physical Size                               | [mm]                 | 459.4(W) x 296.4(H) x 22.8(D) (Typ)              |
| Electrical Interface                        |                      | Even/Odd R/G/B data, 3 sync signal,<br>Clock     |
| Support Color                               |                      | 16.7M colors (RGB 8-bit data )                   |
| Temperature Range                           |                      |                                                  |
| Operating                                   | [°C]                 | 0 to +50                                         |
| Storage (Shipping)                          | [°C]                 | -20 to +60                                       |
| Surface Treatment                           |                      | Hard-coating (3H), Anti-Glare treatment          |
| RoHS                                        |                      | RoHS compliance                                  |





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## 2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25°C :

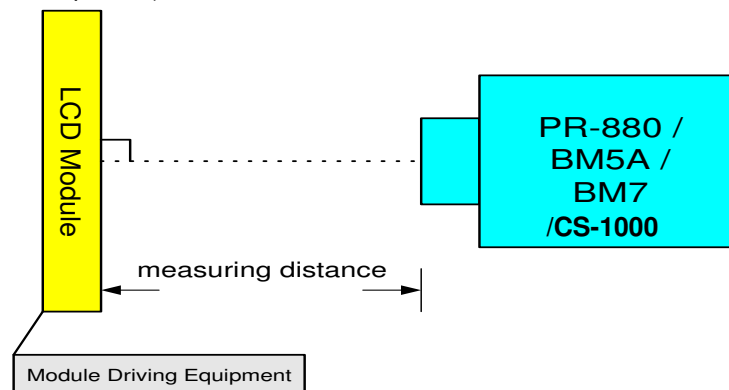
| Item                                                     | Unit                 | Conditions             | Min.  | Typ.  | Max.  | Note          |
|----------------------------------------------------------|----------------------|------------------------|-------|-------|-------|---------------|
| Viewing Angle                                            | [degree]             | Horizontal (Right)     | 75    | 89    | -     |               |
|                                                          | [degree]             | CR = 10 (Left)         | 75    | 89    | -     |               |
|                                                          | [degree]             | Vertical (Up)          | 75    | 89    | -     |               |
|                                                          | [degree]             | CR = 10 (Down)         | 75    | 89    | -     |               |
| Contrast ratio                                           |                      | Normal Direction       | 750   | 1000  |       |               |
| Response Time                                            | [msec]               | Rising Time            | -     | 11    | 25    | <b>Note 1</b> |
|                                                          | [msec]               | Falling Time           | -     | 5     | 15    | <b>Note 1</b> |
|                                                          | [msec]               | Rising + Falling       | -     | 16    | 40    | <b>Note 1</b> |
|                                                          | [msec]               | Grey to Grey (average) | -     | 8     | -     | <b>Note 2</b> |
| Color / Chromaticity Coordinates (CIE)                   |                      | Red x                  | 0.618 | 0.648 | 0.678 |               |
|                                                          |                      | Red y                  | 0.310 | 0.340 | 0.370 |               |
|                                                          |                      | Green x                | 0.257 | 0.287 | 0.317 |               |
|                                                          |                      | Green y                | 0.572 | 0.602 | 0.632 |               |
|                                                          |                      | Blue x                 | 0.114 | 0.145 | 0.175 |               |
|                                                          |                      | Blue y                 | 0.036 | 0.066 | 0.096 |               |
| Color Coordinates (CIE) White                            |                      | White x                | 0.283 | 0.313 | 0.343 |               |
|                                                          |                      | White y                | 0.299 | 0.329 | 0.359 |               |
| White Luminance at CCFL 7.0mA Full White (central point) | [cd/m <sup>2</sup> ] |                        | 240   | 300   | -     |               |
| Luminance Uniformity                                     | [%]                  |                        | 75    | 80    | -     | <b>Note 3</b> |
| Crosstalk (in75Hz)                                       | [%]                  |                        |       |       | 1.5   | <b>Note 4</b> |
| Flicker                                                  | DB                   |                        |       |       | -20   | <b>Note 5</b> |

Equipment: Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (PR 880, BM-5A , BM 7 ,CS-1000, & EZContrast\* )

Aperture : 1° with 100cm viewing distance (VD) or 2° with 50cm viewing distance (VD)

Test Point: Center (VESA point 9)

Environment: < 1 lux



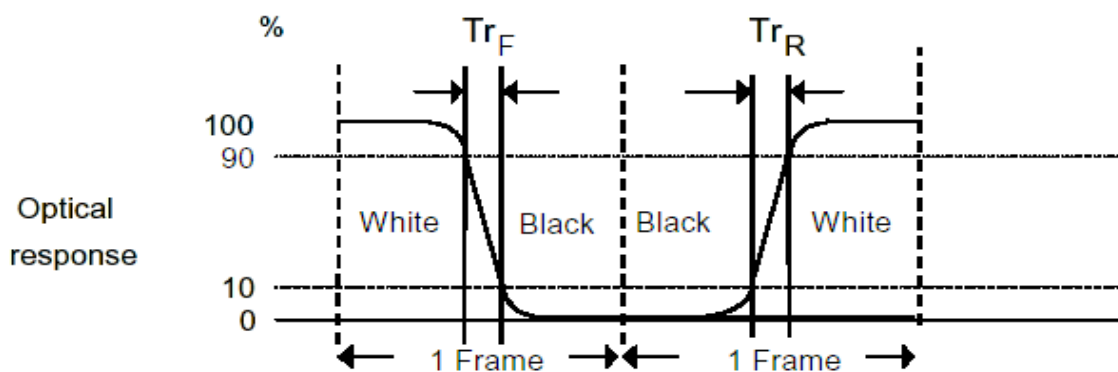


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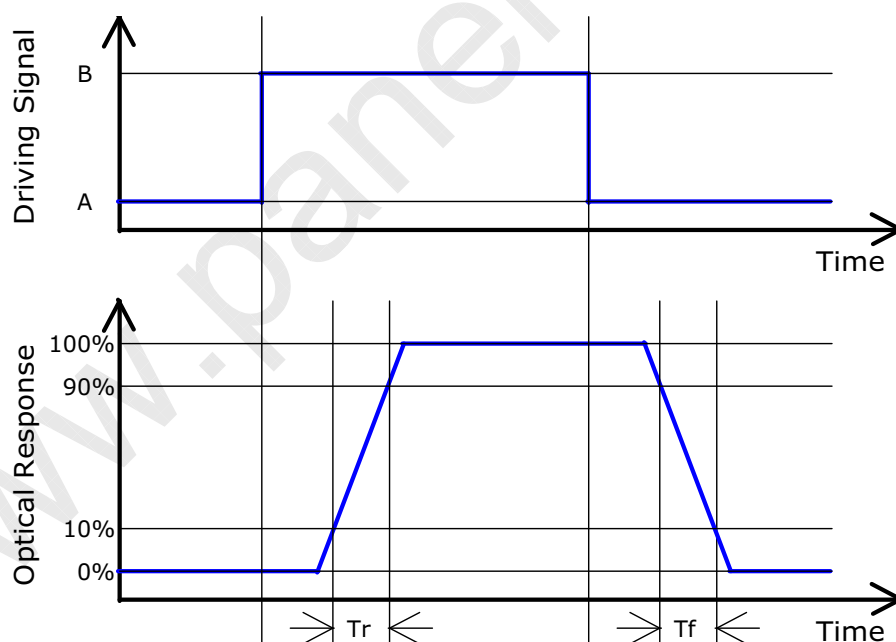
\*1 EZ Contrast is different measurement tool with very close viewing distance.

### Note 1: Definition of Response time

The output signals of photodetector are measured when the input signals are changed from "Black" to "White" (rising time), and from "White" to "Black" (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes.



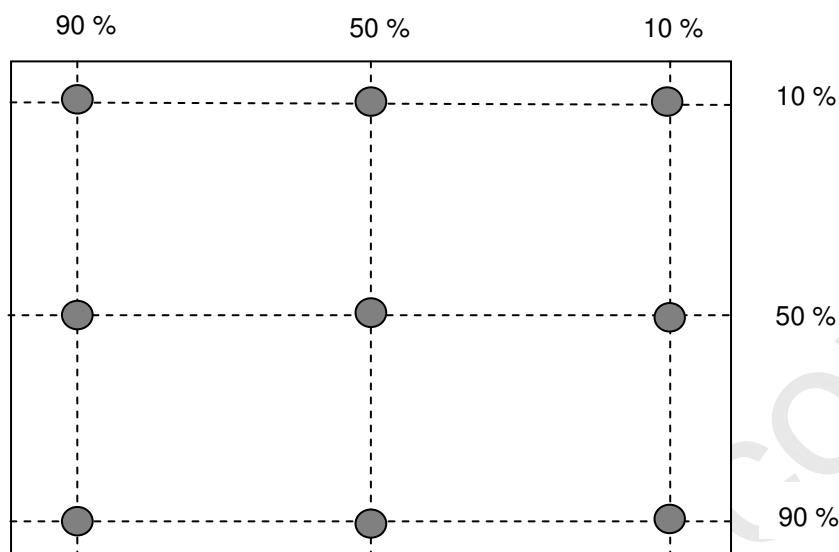
### Note 2: Over-Drive and Response time:



Algorithm:

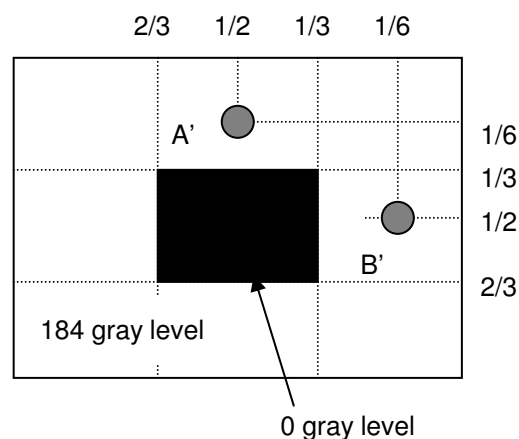
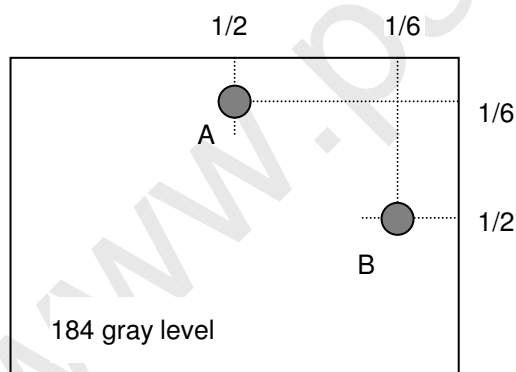
|Level A - Level B|  $\geq 16$  then average  $Tr \leq 8ms$  & average  $Tf \leq 8ms$

**Note 3:** Brightness uniformity of these 9 points is defined as below



$$\text{Uniformity} = \frac{\text{Minimum Luminance in 9 points (1 - 9)}}{\text{Maximum Luminance in 9 Points (1 - 9)}} \times 100\%$$

**Note 4:** Crosstalk is defined as below :



Unit: percentage of dimension of display area

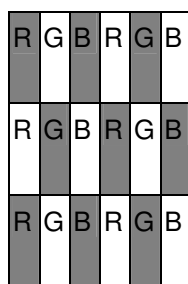
$|L_A - L_{A'}| / L_A \times 100\% = 1.5\% \text{ max.}$ ,  $L_A$  and  $L_B$  are brightness at location A and B

$|L_B - L_{B'}| / L_B \times 100\% = 1.5\% \text{ max.}$ ,  $L_{A'}$  and  $L_{B'}$  are brightness at location A' and B'



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**Note5:** Test Patern: Subchecker Pattern

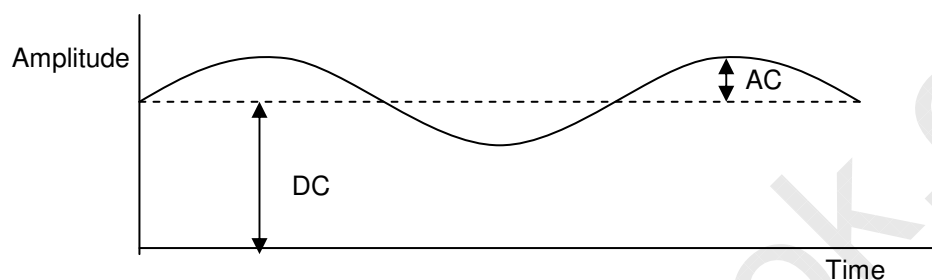


Gray Level = L127



Gray Level = L0

Method: Record dBV & DC value with (WESTAR)TRD-100



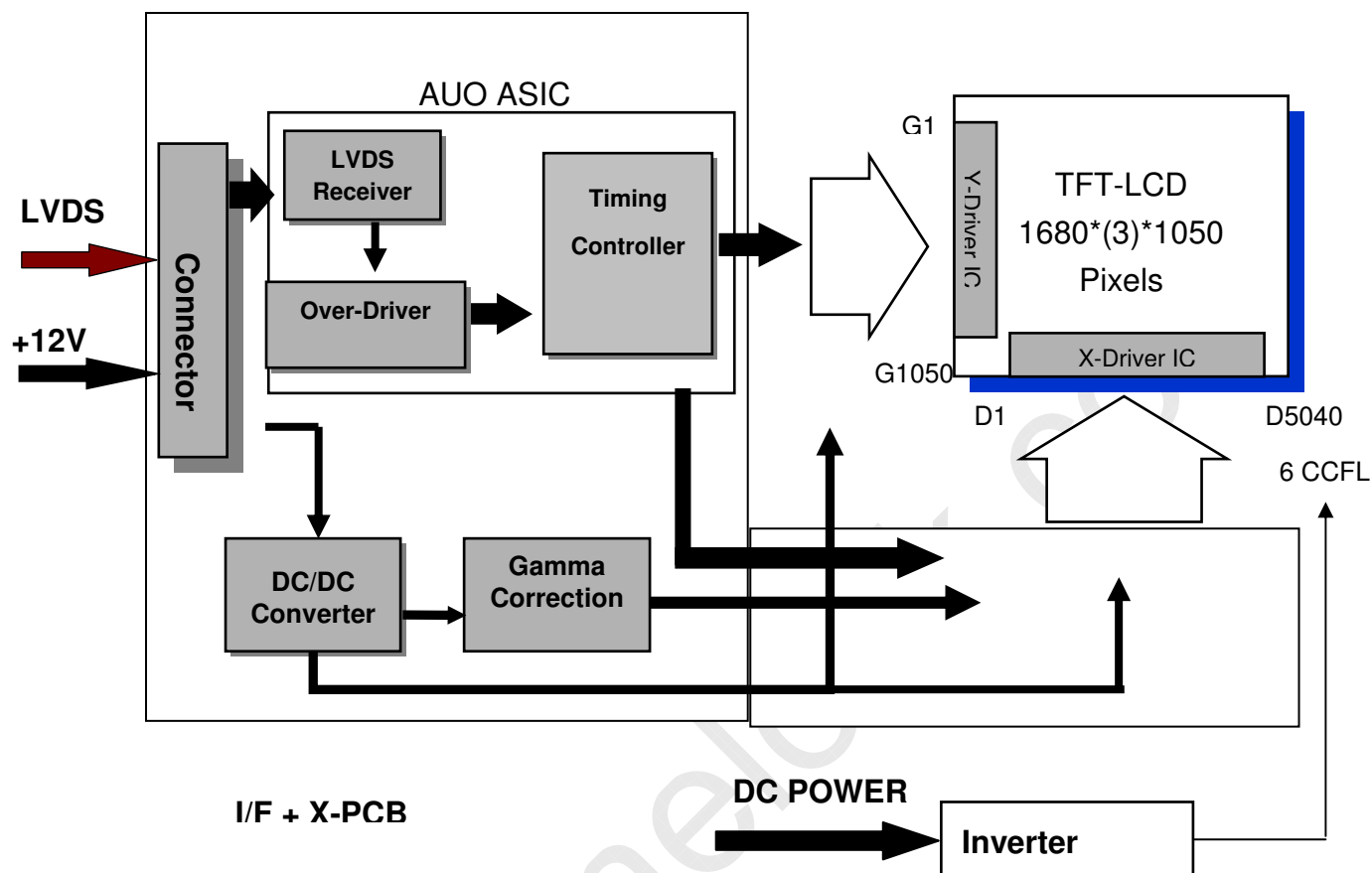
$$\text{Flicker (dB)} = 20 \log \frac{\text{AC Level(at 30 Hz)}}{\text{DC Level}}$$



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### 3.0 Functional Block Diagram

The following diagram shows the functional block of the 20.1 inches wide Color TFT/LCD Module:



JAE: FI-XB30SSL-HF15

JST: BHSR-02VS-1 (2 pin)  
BHSR-05VS-1 (5 pin)

Mating Type:  
JAE: FI-X30S-H

Mating Type:  
SM02B-BHSS-1-TB (2 pin)  
SM04(9-E2)B-BHS-1-TB (5 pin)



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## 4.0 Absolute Maximum Ratings

Absolute maximum ratings of the module is as following:

### 4.1 TFT LCD Module

| Item                    | Symbol | Min  | Max | Unit   | Conditions      |
|-------------------------|--------|------|-----|--------|-----------------|
| Logic/LCD Drive Voltage | VIN    | -0.3 | 14  | [Volt] | <b>Note 1,2</b> |

### 4.2 Backlight Unit

| Item         | Symbol | Min | Max | Unit     | Conditions      |
|--------------|--------|-----|-----|----------|-----------------|
| CCFL Current | ICFL   | -   | 8   | [mA] rms | <b>Note 1,2</b> |

### 4.3 Absolute Ratings of Environment

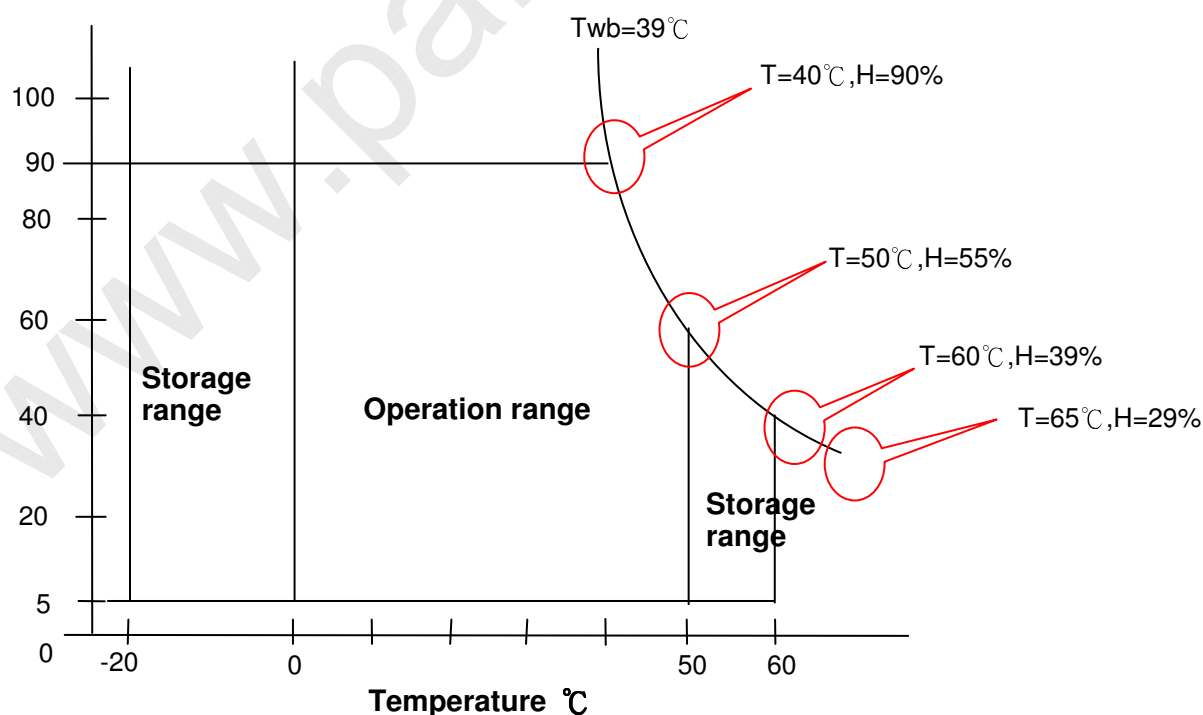
| Item                | Symbol | Min | Max | Unit  | Conditions  |
|---------------------|--------|-----|-----|-------|-------------|
| Operating Humidity  | HOP    | 5   | 90  | [%RH] | <b>Note</b> |
| Storage Temperature | TST    | -20 | +60 | [°C]  | <b>Note</b> |
| Storage Humidity    | HST    | 5   | 90  | [%RH] | <b>Note</b> |

**Note 1:** With in Ta (25°C )

**Note 2:** Permanent damage to the device may occur if exceed maximum values

**Note 3:** Maximum Wet-Bulb should be 39°C and No condensation.

#### Relative Humidity %





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## 5.0 Electrical characteristics

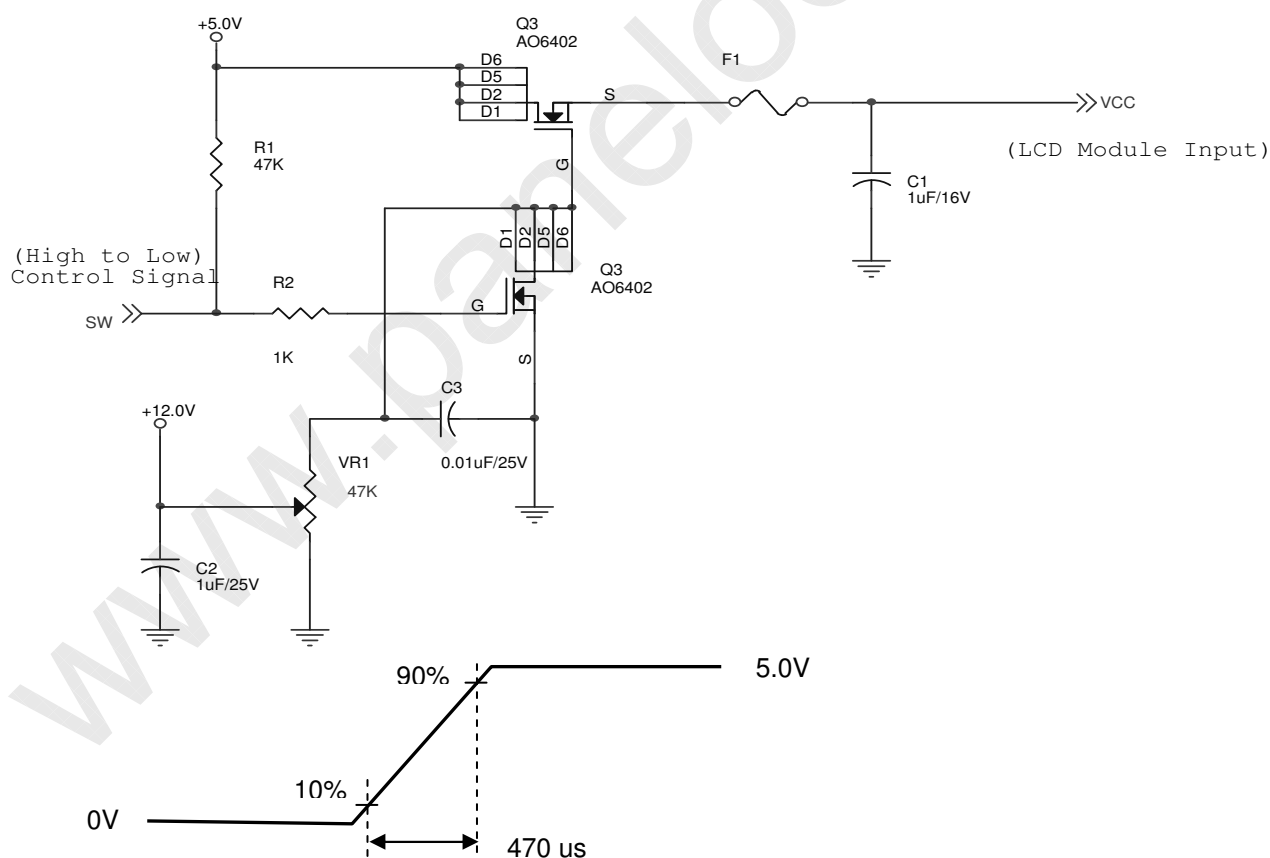
### 5.1 TFT LCD Module

#### 5.1.1 Power Specification

Input power specifications are as follows;

| Symbol | Parameter                                | Min  | Typ | Max  | Units       | Condition                            |
|--------|------------------------------------------|------|-----|------|-------------|--------------------------------------|
| VDD    | Logic/LCD Drive Voltage                  | 10.8 | 12  | 13.2 | [Volt]      | ± 10%                                |
| IDD    | VDD current                              | -    | 550 | 650  | [mA]        | Vin=12V , All White Pattern, at 60Hz |
| Irush  | LCD Inrush Current                       | -    | -   | 2.5  | [A]         | <b>Note</b>                          |
| PDD    | VDD Power                                | -    | 6.6 | 8    | [Watt]      | Vin=12V , All White Pattern, at 60Hz |
| VDDrp  | Allowable Logic/LCD Drive Ripple Voltage |      |     | 100  | [mV]<br>p-p |                                      |

**Note:** Measurement conditions:



**Vin rising time**



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### 5.1.2 Signal Electrical Characteristics

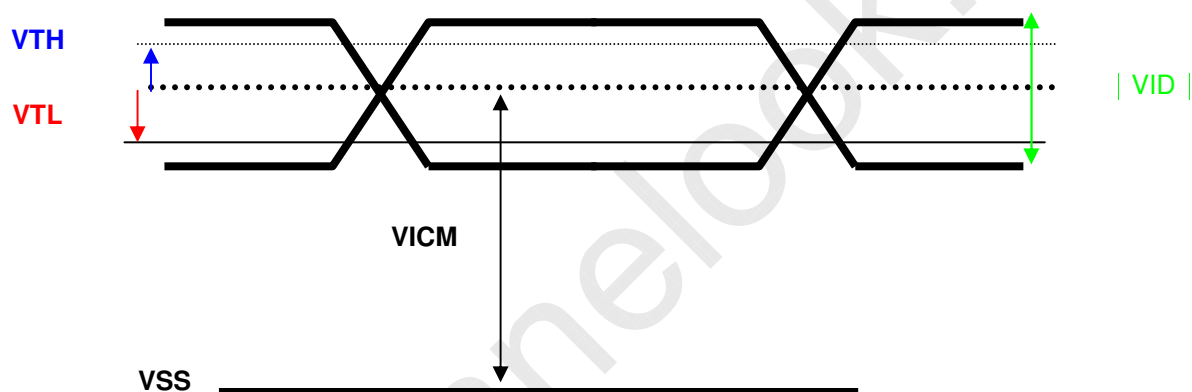
Input signals shall be low or Hi-Z state when Vin is off

It is recommended to refer the specifications of SN75LVDS82DGG (Texas Instruments) in detail.

Each signal characteristics are as follows;

| Symbol | Parameter                              | Min  | Typ  | Max  | Units | Condition                             |
|--------|----------------------------------------|------|------|------|-------|---------------------------------------|
| VTH    | Differential Input High Threshold      | -    | -    | +100 | [mV]  | VICM = 1.2V<br><b>Note</b>            |
| VTL    | Differential Input Low Threshold       | -100 | -    | -    | [mV]  | VICM = 1.2V<br><b>Note</b>            |
| VID    | Input Differential Voltage             | 100  | 400  | 600  | [mV]  | <b>Note</b>                           |
| VICM   | Differential Input Common Mode Voltage | +1.0 | +1.2 | +1.5 | [V]   | VTH/VTL = $\pm 100$ MV<br><b>Note</b> |

**Note:** LVDS Signal Waveform







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## 5.2 Backlight Unit

Parameter guideline for CCFL Inverter

| Symbol         | Parameter                                                    | Min.        | Typ.        | Max.        | Unit          | Condition               |
|----------------|--------------------------------------------------------------|-------------|-------------|-------------|---------------|-------------------------|
| ISCFL          | CCFL standard current                                        | 6.5         | 7.0         | 7.5         | [mA]<br>rms   | (Ta=25°C) <b>Note 1</b> |
| IRCFL          | CCFL operation range                                         | 3.0         | 7.0         | 8.0         | [mA]<br>rms   | (Ta=25°C)               |
| FCFL           | CCFL Frequency                                               | 40          | 55          | 80          | [KHz]         | (Ta=25°C) <b>Note 2</b> |
| ViCFL<br>(0°C) | CCFL Ignition Voltage<br>(End of the lamp wire<br>connector) | 1800        | -           |             | [Volt]<br>rms | (Ta=0°C) <b>Note 3</b>  |
| ViCF<br>(25°C) | CCFL Ignition Voltage<br>(End of the lamp wire<br>connector) | 1450        | -           |             | [Volt]<br>rms | (Ta=25°C) <b>Note 3</b> |
| VCFL           | CCFL Operation Voltage                                       | 751<br>@8mA | 787<br>@7mA | 938<br>@3mA | [Volt]<br>rms | (Ta=25°C) <b>Note 4</b> |
| PCFL           | CCFL Power consumption (for<br>reference)                    | -           | 33.1        | -           | [Watt]        | (Ta=25°C) <b>Note 5</b> |
| LTCFL          | CCFL life Time                                               | 40,000      | 50,000      | -           | [Hour]        | (Ta=25°C) <b>Note 6</b> |

**Note 1:** CCFL standard current is measured at 25±2°C.

**Note 2:** CCFL Frequency should be carefully determined to avoid interference between inverter and TFT LCD

**Note 3:** ViCFL means Ignition Voltage for both ends of the lamp, and CCFL inverter should be able to give out a power that has a generating capacity of over ViCFL for ignition

**Note 4:** CCFL operation voltage is measured at 25±2°C.

**Note 5:** The variance of CCFL power consumption is ±10%. Power is calculated for reference  
(ICFL×VCFL×6=PCFL).

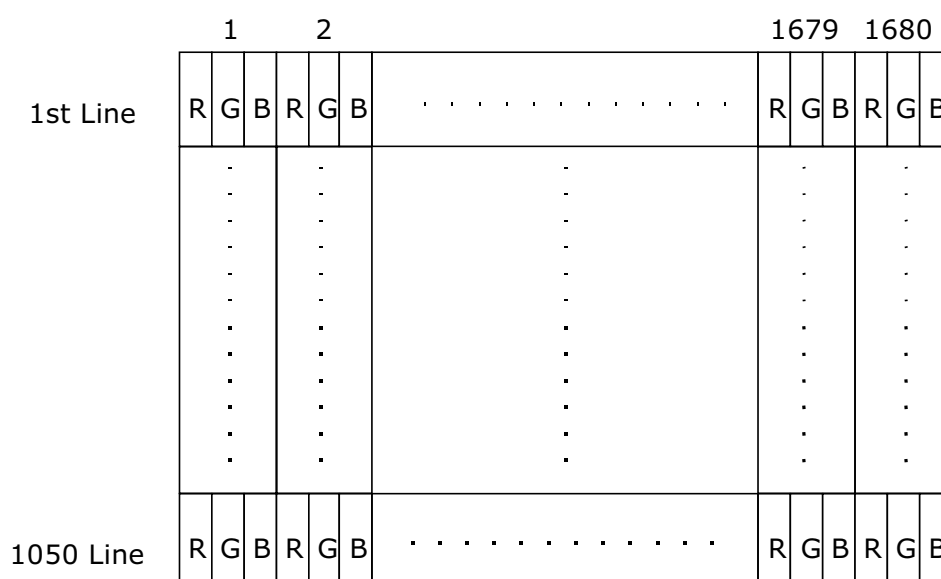
**Note 6:** Definition of life: brightness becomes 50% or less than the minimum luminance value of CCFL..The typical life time of CCFL is on the condition at 7.0 mA lamp current.



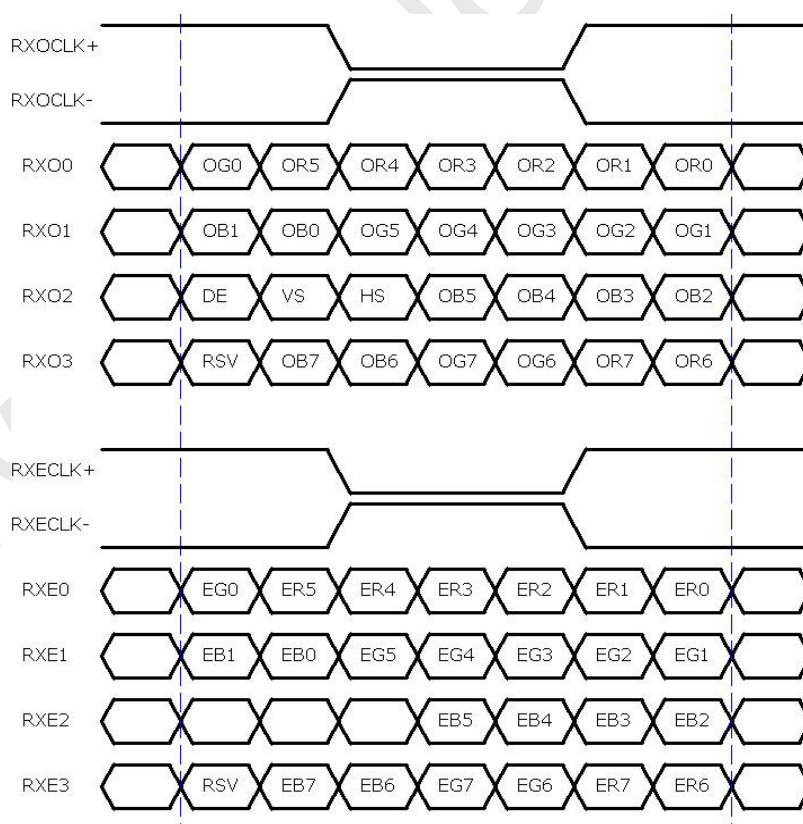
## 6.0 Signal Characteristic

### 6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.



### 6.2 The input data format



**Note 1:** R/G/B data 7:MSB, R/G/B data 0:LSB

O = "First Pixel Data"

E = "Second Pixel Data"



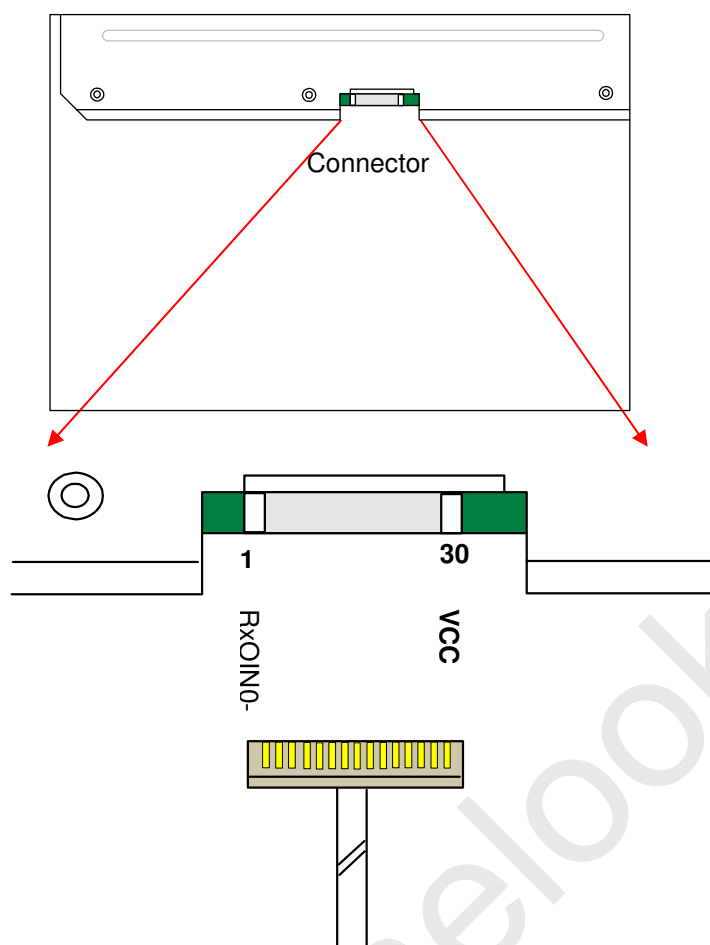
### 6.3 Signal Description

The module using one LVDS receiver SN75LVDS82(Texas Instruments) or compatible. LVDS is a differential signal technology for LCD interface and high speed data transfer device. Transmitter shall be SN75LVDS83(negative edge sampling) or compatible. The first LVDS port(RxOxxx) transmits odd pixels while the second LVDS port(RxExxx) transmits even pixels.

| PIN # | SIGNAL NAME | DESCRIPTION                                                            |
|-------|-------------|------------------------------------------------------------------------|
| 1     | RxO0-       | Negative LVDS differential data input (Odd data)                       |
| 2     | RxO0+       | Positive LVDS differential data input (Odd data)                       |
| 3     | RxO1-       | Negative LVDS differential data input (Odd data)                       |
| 4     | RxO1+       | Positive LVDS differential data input (Odd data)                       |
| 5     | RxO2-       | Negative LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG) |
| 6     | RxO2+       | Positive LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG) |
| 7     | GND         | Power Ground                                                           |
| 8     | RxOC-       | Negative LVDS differential clock input (Odd clock)                     |
| 9     | RxOC+       | Positive LVDS differential clock input (Odd clock)                     |
| 10    | RxO3-       | Negative LVDS differential data input (Odd data)                       |
| 11    | RxO3+       | Positive LVDS differential data input (Odd data)                       |
| 12    | RxE0-       | Negative LVDS differential data input (Even clock)                     |
| 13    | RxE0+       | Positive LVDS differential data input (Even data)                      |
| 14    | GND         | Power Ground                                                           |
| 15    | RxE1-       | Positive LVDS differential data input (Even data)                      |
| 16    | RxE1+       | Negative LVDS differential data input (Even data)                      |
| 17    | GND         | Power Ground                                                           |
| 18    | RxE2-       | Negative LVDS differential data input (Even data)                      |
| 19    | RxE2+       | Positive LVDS differential data input (Even data)                      |
| 20    | RxEC-       | Negative LVDS differential clock input (Even clock)                    |
| 21    | RxEC+       | Positive LVDS differential clock input (Even clock)                    |
| 22    | RxE3-       | Negative LVDS differential data input (Even data)                      |
| 23    | RxE3+       | Positive LVDS differential data input (Even data)                      |
| 24    | GND         | Power Ground                                                           |
| 25    | NC          | No contact (For AUO test only)                                         |
| 26    | NC          | No contact (For AUO test only)                                         |
| 27    | NC          | No contact (For AUO test only)                                         |
| 28    | POWER       | Power                                                                  |
| 29    | POWER       | Power                                                                  |
| 30    | POWER       | Power                                                                  |



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**Note1:** Start from left side**Note2:** Input signals of odd and even clock shall be the same timing.

## 6.4 Timing Characteristics

Basically, interface timings described here is not actual input timing of LCD module but output timing of SN75LVDS82DGG (Texas Instruments) or equivalent.

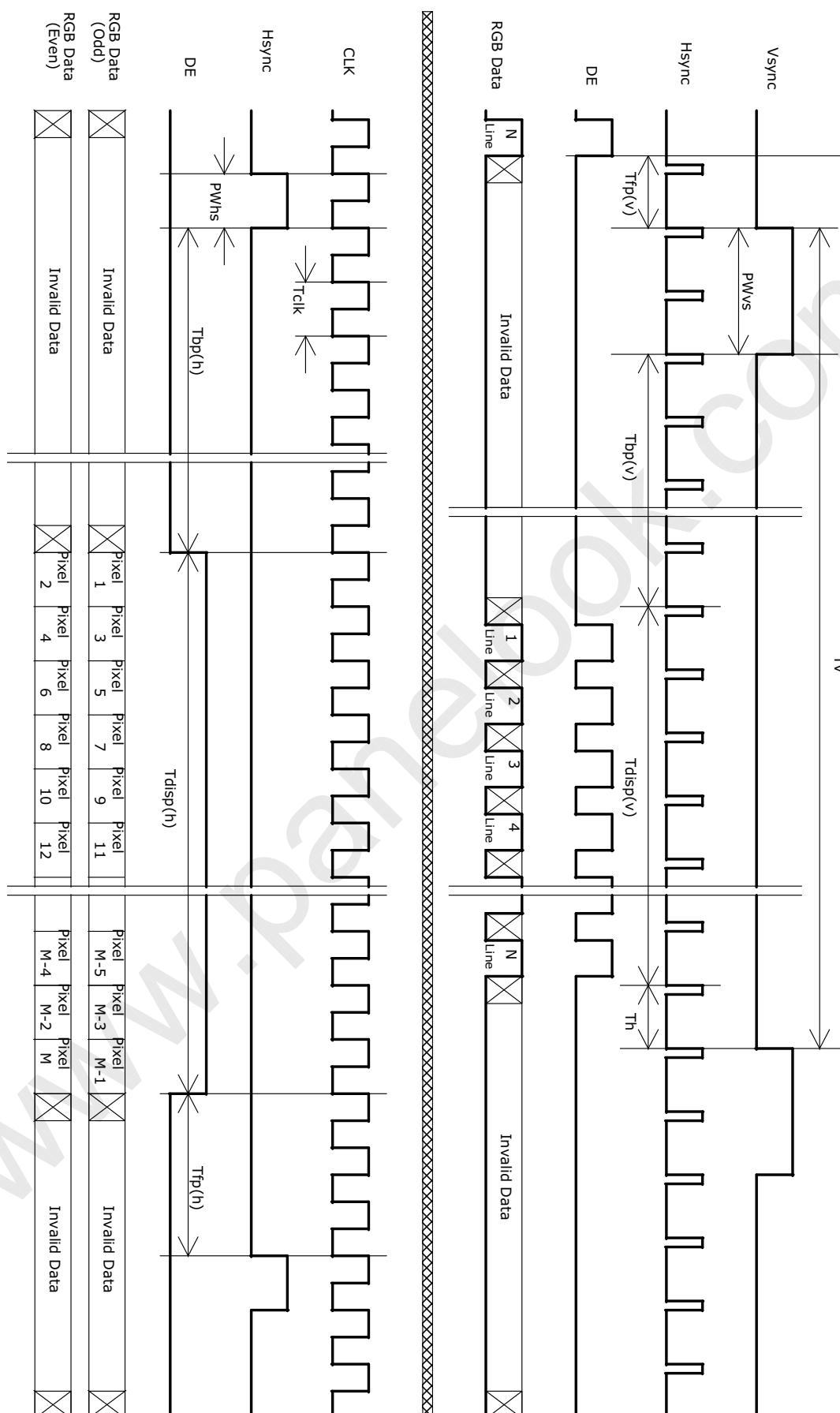
| Signal             | Item       | Symbol                        | Min  | Typ  | Max   | Unit |
|--------------------|------------|-------------------------------|------|------|-------|------|
| Vertical Section   | Period     | $T_v$                         | 1061 | 1087 | 1600  | Th   |
|                    | Active     | $T_{disp(v)}$                 | 1050 | 1050 | 1050  | Th   |
|                    | Blanking   | $T_{bp(v)}+T_{fp(v)}+PW_{vs}$ | 11   | 37   | 550   | Th   |
| Horizontal Section | Period     | $T_h$                         | 920  | 1128 | 1400  | Tclk |
|                    | Active     | $T_{disp(h)}$                 | 840  | 840  | 840   | Tclk |
|                    | Blanking   | $T_{bp(h)}+T_{fp(h)}+PW_{hs}$ | 80   | 288  | 560   | Tclk |
| Clock              | Period     | $T_{clk}$                     | 13.3 | 13.6 | 16.67 | ns   |
|                    | Frequency  | Freq                          | 60   | 73.5 | 75    | MHz  |
| Frame rate         | Frame rate | F                             | 55   | 60   | 75    | Hz   |

**Note :** DE mode only



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### 6.4.1 Timing diagram



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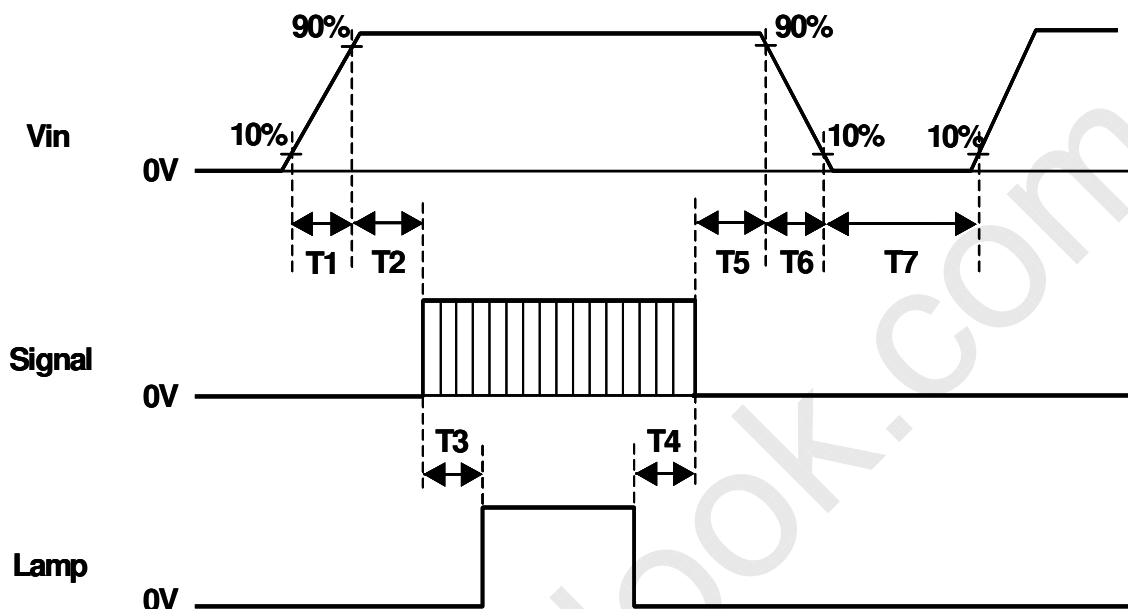
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## 6.5 Power ON/OFF Sequence

Vin power and lamp on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when Vin is off.



| Symbol | Values |     |     | Unit |
|--------|--------|-----|-----|------|
|        | Min    | Typ | Max |      |
| T1     | 0.5    | -   | 10  | [ms] |
| T2     | 0.5    | 40  | 50  | [ms] |
| T3     | 200    | -   | -   | [ms] |
| T4     | 200    | -   | -   | [ms] |
| T5     | 0.5    | 16  | 50  | [ms] |
| T6     | -      | -   | 10  | [ms] |
| T7     | 1000   | -   | -   | [ms] |



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## 7.0 Connector & Pin Assignment

Physical interface is described as for the connector on module.

These connectors are capable of accommodating the following signals and will be following components.

### 7.1 TFT LCD Module

|                                     |                                      |
|-------------------------------------|--------------------------------------|
| <b>Connector Name / Designation</b> | Interface Connector / Interface card |
| <b>Manufacturer</b>                 | JAE or compatible                    |
| <b>Type Part Number</b>             | FI-XB30SSL-HF15                      |
| <b>Mating Housing Part Number</b>   | JAE: FI-X30S-H                       |

| Pin# | Signal Name | Pin# | Signal Name |
|------|-------------|------|-------------|
| 1    | RxO0-       | 2    | RxO0+       |
| 3    | RxO1-       | 4    | RxO1+       |
| 5    | RxO2-       | 6    | RxO2+       |
| 7    | GND         | 8    | RxOC-       |
| 9    | RxOC+       | 10   | RxO3-       |
| 11   | RxO3+       | 12   | RxE0-       |
| 13   | RxE0+       | 14   | GND         |
| 15   | RxE1-       | 16   | RxE1+       |
| 17   | GND         | 18   | RxE2-       |
| 19   | RxE2+       | 20   | RxEC-       |
| 21   | RxEC+       | 22   | RxE3-       |
| 23   | RxE3+       | 24   | GND         |
| 25   | NC          | 26   | NC          |
| 27   | NC          | 28   | Power       |
| 29   | Power       | 30   | Power       |



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## 7.2 Backlight Unit

|                                     |                                                         |
|-------------------------------------|---------------------------------------------------------|
| <b>Connector Name / Designation</b> | Lamp Connector / Backlight lamp                         |
| <b>Manufacturer</b>                 | JST                                                     |
| <b>Type Part Number</b>             | BHSR-02VS-1 (CN3/CN4)<br>BHSR-05VS-1 (CN2/CN5)          |
| <b>Mating Type Part Number</b>      | SM02B-BHSS-1-TB (2pin)<br>SM04 (9-E2) B-BHS-1-TB (5pin) |

## 7.3 Signal for Lamp connector

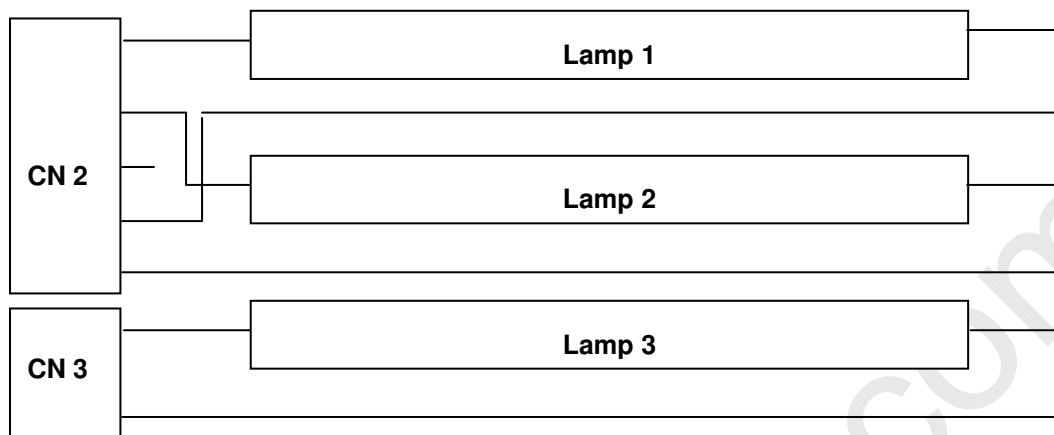
|       | Connector No. | Pin No. | Color     | Function              |
|-------|---------------|---------|-----------|-----------------------|
| Upper | CN2           | 1       | Pink      | High Voltage (Lamp 1) |
|       |               | 2       | Sky Blue  | High Voltage (Lamp 2) |
|       |               | 3       | NC        | NC                    |
|       |               | 4       | Black     | Low Voltage (Lamp 1)  |
|       |               | 5       | Dark Blue | Low Voltage (Lamp 2)  |
|       | CN3           | 1       | White     | High Voltage (Lamp 3) |
|       |               | 2       | White     | Low Voltage (Lamp 3)  |
| Lower | CN4           | 1       | White     | High Voltage (Lamp 4) |
|       |               | 2       | White     | Low Voltage (Lamp 4)  |
|       | CN5           | 1       | Pink      | High Voltage (Lamp 6) |
|       |               | 2       | Sky Blue  | High Voltage (Lamp 5) |
|       |               | 3       | NC        | NC                    |
|       |               | 4       | Black     | Low Voltage (Lamp 6)  |
|       |               | 5       | Dark Blue | Low Voltage (Lamp 5)  |



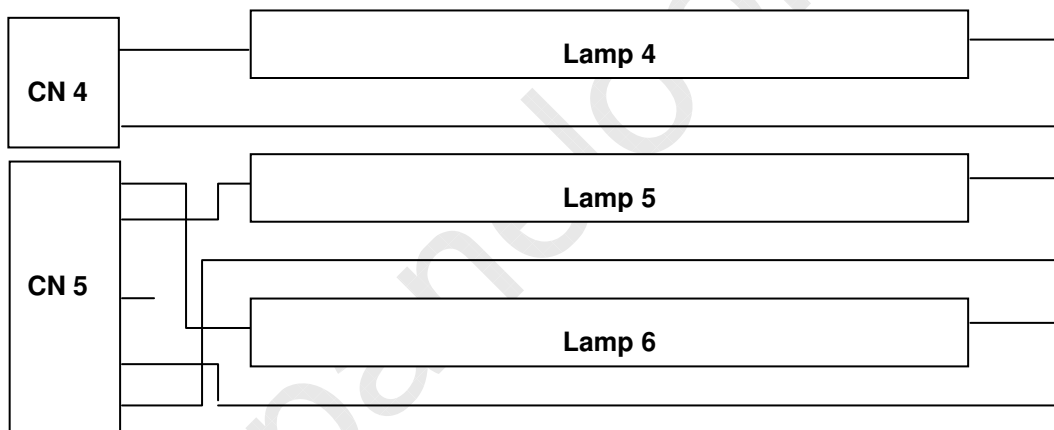


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Upper



Lower





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## 8.0 Reliability

Reliability test condition

| No | Test Item                        | Test Condition                                                                                                                                                          |
|----|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Temperature Humidity Bias (THB)  | 50℃, 80%, 300hours                                                                                                                                                      |
| 2  | High Temperature Operation (HTO) | 50℃, 300hours                                                                                                                                                           |
| 3  | Low Temperature Operation (LTO)  | 0℃, 300hours                                                                                                                                                            |
| 4  | High Temperature Storage (HTS)   | 60℃, 300hours                                                                                                                                                           |
| 5  | Low Temperature Storage (LTS)    | -20℃, 300hours                                                                                                                                                          |
| 6  | Thermal Shock Test (TST)         | -20℃/30min, 60℃/30min, 100 cycles                                                                                                                                       |
| 7  | On/Off Test                      | On/10sec, Off/10sec, 30,000 cycles                                                                                                                                      |
| 8  | Shock Test (Non-Operating)       | 50G, 20ms, Half-sine wave ( $\pm X$ , $\pm Y$ , $\pm Z$ )                                                                                                               |
| 9  | Vibration Test (Non-Operating)   | 1.5G(10~200Hz P- P), 30 Minutes each Axis (X, Y, Z)                                                                                                                     |
| 10 | Drop test                        | Package test: The drop height is 60cm.                                                                                                                                  |
| 11 | ESD (ElectroStatic Discharge)    | Contact Discharge: $\pm 8KV$ , 150pF(330 $\Omega$ ) 1sec, 8 points, 25 times/ point<br>Air Discharge: $\pm 15KV$ , 150pF(330 $\Omega$ ) 1sec, 8 points, 25 times/ point |
| 12 | Altitude Test                    | Operation:10,000 ft<br>Non-Operation:30,000 ft                                                                                                                          |



## 9.0 Environment

The display module will meet the provision of this specification during operating condition or after storage or shipment condition specified below. Operation at 10% beyond the specified range will not cause physical damage to the unit.

### 9.1 Temperature and Humidity

#### 9.1.1 Operating Conditions

The display module operates error free, when operated under the following conditions;

|                      |               |
|----------------------|---------------|
| Temperature          | 0 °C to 50 °C |
| Relative Humidity    | 5% to 90%     |
| Wet Bulb Temperature | 39.0 °C       |

#### 9.1.2 Shipping Conditions

The display module operates error free, after the following conditions;

|                      |                 |
|----------------------|-----------------|
| Temperature          | -20 °C to 60 °C |
| Relative Humidity    | 5% to 90%       |
| Wet Bulb Temperature | 39.0 °C         |

### 9.2 Atmospheric Pressure

The display assembly is capable of being operated without affecting its operations over the pressure range as following specified;

|                  | Pressure | Note                |
|------------------|----------|---------------------|
| Maximum Pressure | 1040hPa  | 0m = sea level      |
| Minimum Pressure | 674hPa   | 3048m = 10.000 feet |

Note : Non-operation attitude limit of this display module = 30,000 feet. = 9145 m.



## 10.0 Safety

### 10.1 Sharp Edge Requirements

There will be no sharp edges or comers on the display assembly that could cause injury.

## 10.2 Materials

### 10.2.1 Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible ADT Toxicologist.

### 10.2.2 Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process.

The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

## 10.3 Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.



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## 11.0 Other requirement

### 11.1 National Test Lab Requirement

The display module will satisfy all requirements for compliance to

**UL 1950, First Edition**

**CSA C22.2 No.950-M89**

**EEC 950**

**EN 60 950**

U.S.A. Information Technology Equipment

Canada, Information Technology Equipment

International, Information Technology Equipment

International, Information Processing Equipment

(European Norm for IEC950)

### 11.2 Label

The label is on the panel as shown below:





